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Numerical modelling (2D-3D) of a subducting asperity: application to the Louisville Ridge in the Tonga subduction zone.

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The Tonga subduction zone has the fastest convergence rate ever seen on the Earth (i.e 24 cm/y) and is associated with a southward propagation of a back-arc basin opening. Although lots of geodynamics models aim at explaining the evolution of this subduction system, the different steps are still poorly understood. Moreover, this zone is characterised by the southward sweeping of the Louisville ridge along the trench. What are the effects of an asperity on the overriding plate deformation and dynamic subduction?.

We used a finite elements code (ADELI in 2D and 3D) (Hassani et al.,1997) which allows to perform a thermo-mechanical modelling of the subduction. In this modelling, the lithosphere is assumed to behave as an elastoplastic medium at low temperature and as viscoelastic medium at high temperature. The asperity is characterised by a simple topography, a density and mechanical parameters. Our 2D results show that the development of deformation in the two plates depends on lots of parameters such as the time of arrival of the asperity at the trench, the size of the asperity, its density and in particular the velocity of the two plates; i.e. due to a slight dip variation the asperity subduction enhances a compressive stress in the arc area and then delays the geometrical extensional deformation in the arc zone. Our 3D preliminary results seem to indicate that the obliquity of the convergence and the geometry of the margin affect also the deformation in the upper plate.